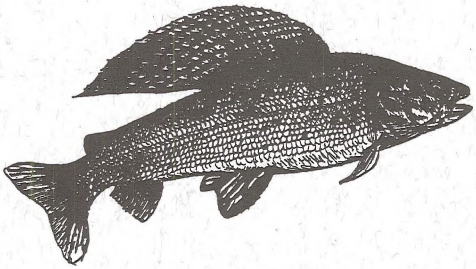
...rtment of the Interior
Bureau of Land Management

Alaska State Office
222 West 7th, #13
Anchorage, Alaska 99513

Fisheries Investigations in the Beaver Creek Drainage, White Mountains National Recreation Area, Alaska, 1989

Louis Carufel



BLM-Alaska Open File Report 31
December 1990

Authors

Louis Carufel is a retired fisheries biologist who formerly worked with the BLM's Steese/White Mountains District Office in Fairbanks, Alaska. He completed this report as a volunteer after retirement.

Artwork

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INTRODUCTION

Fisheries surveys of Beaver Creek upstream from its confluence with Victoria Creek, conducted by personnel from the Bureau of Land Management from June 1 to September 22, 1989, are summarized in this Open File Report. The purpose of these investigations was to carry out the objectives of the draft White Mountains Aquatic Habitat Management Plan. Those objectives are to (1) monitor the effect of recreational use on the sport fishing quality, (2) inventory limnological parameters of the fishery habitat of Beaver Creek and its tributaries, and (3) monitor and plan fish enhancement for Nome Creek, a tributary of Beaver Creek. This 1989 report is a continuation of Open File Report 24.

STUDY AREA

A detailed description of the Beaver Creek drainage appeared in Carufel's Open File Report 24 (1988). The upper Beaver Creek drainage was reported by Rhine (1985) and Kretsinger (1986).

SPECIES PRESENT

Anadromous and resident fish species occur in the Beaver Creek drainage. Only limited data are available for arctic grayling and almost none exists for other species. Fish species found in the portion of the streams which lie within the White Mountains National Recreation Area include arctic grayling, round whitefish, burbot, sheefish, northern pike, slimy sculpin, longnose sucker, chinook salmon and chum salmon. Scientific names of the species found are listed in Appendix 1.

METHODOLOGY

Inventories and monitoring of Beaver Creek index sites were conducted at the following wild river miles (WRM):

	WRM
Borealis Cabin	32.0
Groundwater Springs	39.0
Fossil Creek	46.0
Willow Creek	88.0
Sheep Creek	90.5
Warren Creek	98.5
Victoria Creek	111.0

A. Water Quality and Fish Population Evaluation

Water quality parameters related to fish habitat and fish populations were recorded at each of the above 7 index sites on Beaver Creek.

B. River Users

Ten 1-hour reconnaissances flights to observe all river uses were made between the origin of Beaver Creek (WRM 0, Figure 1) and Victoria Creek (WRM 111, Figure 1) between 8 a.m. and 5 p.m. The time frames were selected at random. A survey was conducted every

10 days after June 1. The 1989 aerial surveys covered June 8 to September 8. A standard form was used to record the observations (Table 6). A fixed-wing aircraft was used to make the survey overflights. Result estimates for Table 4 were changed to the number of people instead of total hours because people numbers appear to be more meaningful.

C. Revegetation and Riparian Habitat Enhancement

Field observations were made of the Nome Creek drainage to determine potential areas of stream habitat enhancement opportunities. A study plot (Figure 4) using grasses, established in 1988 on the west side (Township 6 North; Range 5 East; Section 12 of the SE 1/4) of Pavey's mining operation, was monitored and evaluated to determine the feasibility of growing grass to control surface runoff from reclaimed mine areas.

Seven additional sites (Figure 4) of various sizes (a total of 2 acres) adjacent to the study plot were planted with grasses and willows. Also, natural vegetation occurrence in these planted sites was monitored.

Additional habitat enhancement work was conducted on tailings sites in the Maze section (Township 6 North; Range 5 East; Section 20) using grasses, willows and fertilizers. Nine tailing sites in the Maze section (Figure 5) were selected for revegetation trials. Three different treatments were used. One treatment on 3 sites consisted of planting 10 different grass species in adjacent strips. Each strip ranged from 10 to 20 feet wide and 10 to 20 feet long. The following grass species were used individually or as a mixture:

Gruening Alpine Bluegrass - *Poa alpina*
Tundra Glaucous Bluegrass - *Poa glauca*
Alyeska Polargrass - *Arctagrostis latifolia*
Norcoast Bering Hairgrass - *Deschampsie beringensis*
Nortran Tufted Hairgrass - *Deschampsie caespitose*
Egan Sloughgrass - *Beckmannia syzigachne*
Sourdough Bluejoint Reedgrass - *Calamagrostis canadensis*
Siberian Wildrye - *Elymus sibiricus*
Arctared Red Fescue - *Festuce rubra*
Tellesy Sage - *Artemisia Tilesii*

Two sites were planted with a seed mix combining the 10 species and finally, four sites were fertilized only, with no seeding. All of the sites were fertilized with approximately 450 pounds per acre of 20-20-10 fertilizer.

D. Lake Surveys

Field observations on lakes in the White Mountains National Recreational Area were conducted for potential recreational fishing sites. Configurations of one lake are listed in Figure 3.

Transportation to and from sampling sites was by a Cessna 185 fixed- wing aircraft, a 206 L1 Long Ranger helicopter, a snow machine and a four-wheel drive vehicle as needed. Beaver Creek was floated with a Campways Hopi rubber raft.

Fish populations were observed, sampled and captured using seines, gill nets, and hook and line. Fish were measured and weighed. Adult fish were measured in fork length (FL) and recorded in millimeters (mm). Juvenile fish, when captured, were measured in total

length (TL) and recorded in millimeters. Weights were recorded in ounces and later converted to grams. The K factor (degree of well-being) was computed and recorded.

Age determination was calculated from the fish scale samples collected. The scale samples collected were cleaned with detergent, mounted, placed on acetate strips and pressed. Age was determined later using a Microfiche reader.

Water quality parameters were measured using a Hach water chemistry kit, Model AL36-B. Turbidity was measured with a portable H. F. Scientific turbidimeter, Model DRT-15. Stream velocities and discharge, when recorded, were taken with the velocity head rod method. Photos were taken of the sampling sites with a 35mm Pentax camera. Field notes and data were documented in notebooks and on special forms. Field data is stored in a computer and in the files of BLM's Steese/White Mountains District Office.

RESULTS

A. Water Quality and Fish Population Evaluation

Seven index sites were sampled from June 14 to 18 in 1989. Water quality analyses were conducted in the field. Turbidity readings of the field samples were analyzed in the lab. Table 1 lists the water quality parameters sampled.

A total of 50 grayling *(Thymallus arcticus)* were captured by hook and line throughout the survey of the 7 index sites. Thirty-five fish were sacrificed for sex determinations, scale samples, and length and weight measurements.

The captured fish ranged from 140 to 349 mm in fork length (5.5-13.75 inches) and ranged from 28 to 368 grams in weight (1-13 ounces). Average fork length was 266 mm and average weight was 193 grams.

The sex ratio for grayling examined was 60% males to 40% females. Males ranged from 140 to 305 mm in fork length (average 218 mm) and from 28 to 283 grams in weight

Table 1. Water quality readings of Beaver Creek index sites–June 1989

	PARAMETERS				
Index Stations	pH	Total Alkalinity	Total Hardness*	Turbidity (NTU)	Dissolved Oxygen
WRM 32.0	6.7	2.0	2.0	.26	7.0
WRM 39.0	6.7	2.0	2.0	.24	8.0
WRM 46.0	6.9	3.0	5.0	.21	6.0
WRM 88.0	6.9	4.0	6.0	.22	8.0
WRM 90.5	6.9	3.0	8.0	.11	6.0
WRM 98.5	7.0	4.0	8.0	.10	8.0
WRM 111.0	7.1	0.0	8.0	.18	7.0

* grains per gallon
WRM= wild river mile

(average 159 grams). Females ranged from 170 to 300 mm in length (average 232 mm) and from 57 to 312 grams in weight (average 149 grams).

The K factor of the fish sampled was calculated for each index site and areas between sites. The K factor is the relationship of the length and weight of fish. The weight of a fish varies with the cube of its length, provided the shape and specific gravity remain the same. Generally, a result of 1.0 or above reflects good condition or well-being. The K factor is used to express relative robustness of fish and to indicate the suitability of an environment for fish. The fork length ranges and averages are summarized in Table 2.

Table 2. Total number of grayling *(Thymallus arcticus)* taken, fork length and average K Factor for each index site-1989.

Index Station (WRM)	Number of Fish	Length		K Factor (Average)
		Size Range (mm)	Average Size (mm)	
32.0	18	245-305	274.0	1.0
39.0	3	241-267	251.0	1.0
46.0	5	241-343	284.0	.95
88.0	7	254-305	278.0	.90
90.5	0			-
98.5	5	254-318	282.0	.90
111.0	12	140-349	235.0	.94
Total	50			

WRM= wild river mile

Fifty grayling were captured by gill net and hook and line. Each index site was sampled for one hour. The areas between each site were sampled randomly for a total of two hours. Sampling resulted in a catch rate of 5.5 fish per hour.

An age frequency and fork length analysis was prepared for the grayling captured in the June survey. This was calculated for all index sites together as a whole. Mean lengths, percent and standard deviation for each age class is presented in Table 3. Scales from one

Table 3. Age frequency and fork length of grayling *(Thymallus arcticus)* captured in Beaver Creek in the White Mountains National Recreation Area, June 13-19, 1989.

Age Class	No. Fish	Mean Length (mm)	Range	Percent of total	Standard Deviation
2	1	140	140	3	-
3	2	171	171	6	-
4	5	235	204-260	15	20.1
5	9	262	241-279	26	11.6
6	11	294	267-318	32	14.3
7	5	298	267-349	15	23.9
8	1	343	343	3	-
9					
Total	34			100	

grayling could not be read because the scale used in the analysis was regenerated. Age class determinations were made for 34 grayling.

B. River Users

Aerial surveys to record recreation and other use on Beaver Creek resulted in a total of 10 flights of one hour each. Eight parties were counted; they contained a total of 18 people, for an average of 2.25 people per party. The time frame was from June 1 to September 15, covering a total of 107 days.

Table 4. Beaver Creek aerial survey, user counts for 1989.

Date	1= Weekday 2= Weekend	Section	Time	Count		
				People	Watercraft	Aircraft
June 8	1	A	3 p.m.	0	0	0
June 18	1	B	10 a.m.	6	3	0
June 30	1	B	5 p.m.	0	0	0
July 9	1	A	8 a.m.	0	0	0
July 18	2	A	2 p.m.	0	0	0
July 28	1	B	4 p.m.	7	3	0
August 8	1	B	11 a.m.	5	2	0
August 18	1	A	1 p.m.	0	0	0
August 28	2	B	12 p.m.	0	0	0
Sept. 8	1	A	9 a.m.	0	0	0
			Mean	6.0	2.7	0
			Standard Deviation	0.82	0.5	0

Projection of the survey results are as follows: 10 samples in 107 days = 9.3% of total time sampled, and observed 8 parties with a total of 18 persons. Sample expanded to 100% (or 107 days) = 8 parties x 107 = 86 parties with 241 persons using the river. Table 4 depicts the user counts for 1989.

During the user surveys in July and September 1989, observations were made for salmon movements in Beaver Creek (Figure 1). Clarity of water and sunny days provided good observations, but salmon were not sighted during the aerial surveys. Chinook salmon (35) were observed and reported by the wildlife team doing survey work along Beaver Creek from July 26 to August 8, 1989. These salmon were observed spawning in deep riffles, often behind log obstructions. Salmon presence was documented below Shebal's at WRM 47 (Township 8 North; Range 1 West; Section 36) to WRM 110 (Township 11 North; Range 5 East; Section 2). Most of the spawners were observed at WRM 82 (Township 10 North; Range 2 East; Section 1).

C. Revegetation and Riparian Habitat Enhancement

Water quality samples were collected from Nome Creek on September 21, 1989. Two samples were taken in the Maze at the same sites as in 1988. One was taken at the head of the Maze and one at the end of the Maze (Township 6 North; Range 5 East; Sections 19 and 20), see Figure 1, A. Results are listed on Table 5.

Table 5. Nome Creek water quality readings from the Maze, September 21, 1989.

Sample Size	DO_2 (Mg/l)	CO_2 (Mg/l)	pH	Total		Turbidity	Flows
				Alkalinity	Hardness*	(NPU)	(cfs)
Head of Meander	10.0	0.0	7.0	2.0	4.0	0.0	NM
End of Meander	11.0	0.0	6.9	2.0	3.0	0.0	NM

* grains per gallon; DO_2 = dissolved oxygen; CO_2 = carbon dioxide; NM = not measured

In general, readings were about the same between the head and the end of the meander. The readings were about the same as in 1987. There were no variations in dissolved oxygen and carbon dioxide readings between the 2 stations in the Maze section as in 1988.

During the summer of 1989, riparian habitat enhancement test plots were monitored and evaluated. These observations included 2 additional sites in the area of Hope and Birch creeks, outside of Nome Creek drainage. Four reclaimed placer mine sites in the Hope, Birch and Nome creeks drainages were planted with grass test plots in June 1988. Each site was planted with 50 species of grass, both native and domestic, to determine feasibility of using grass for reducing surface runoff and to revegetate mine sites. Additional monitoring and evaluations of several sites in the Pavey area and the Maze section were conducted. This work is being done in conjunction with the Alaska Department of Natural Resources-Plant Material Center.

Evaluations made by the Plant Material Center on August 29, 1989, indicated that grass can provide vegetative cover (see Appendix 2). Evaluation data collected after the first growing season are limited to recording percent cover and vigor for each taxa. Additional data will be collected in subsequent years.

The vigor ratings are based on a scale of 1-9, with 1 representing the highest rating. Many plantings that appear to be particularly successful after one growing season will be lost during the winter or perform poorly in subsequent years. Many native grass species not performing well at this time will do better in later years. Native grasses are known for not exhibiting much vigor during their seedling years. Refer to Appendix 2.

The test plots, planted in 1988, have gone through 1 winter and can provide data for updating growth performance during the evaluations. Continued evaluations of these test plots over at least 2 more years will yield useful information in determining which grasses best revegetate mine tailings. The variations in yearly growing conditions will be more accurately reflected in the growth and survival performance of grass species (see Appendix 2).

Evaluations made August 29, 1989, revealed that three-quarters of the Birch Creek #1 plot had been washed out from early spring flood waters. This test plot is no longer being evaluated, but the performances of the remaining species will be noted during evaluations of Birch Creek #2 plot.

The 3 remaining plots, Birch Creek #2, Hope Creek and Nome Creek, will be used to determine the species of grasses most suitable for revegetation of the mine tailings. Taxa that have performed well at these sites include: Gruening Alpine Bluegrass, *Poa ampla*; the native wheatgrasses *Agropyron yukonese* or *A. boreal*; Engmo Timothy, *Elymus sibiricus 345600*; Nortan Tufted Hairgrass and Arctared Red Fescue. Norcoast Bering Hairgrass has shown mixed performances at the sites and there have been no definite differences in performance between Manchar and Carlton Smooth Brome. *Poa ampla*, Engmo Timothy and the Bromes are non-native species.

D. Lake Surveys

Colorado Creek Lake (Figure 3) was tested April 22, 1989, for dissolved oxygen. Four test holes were sampled. There were about 3.5 feet of ice over water depths of 2.5 to 5.5 feet at the test sites. Dissolved oxygen readings ranged from 0.0 to 3.0 ppm. The ice was clear for most part, with two feet of packed snow over the lake.

DISCUSSION

Habitat surveys made during 1986 (Van Haveren et al.), 1988 and 1989 documented available fish habitat for anadromous and resident fish species in Beaver Creek. The presence of grayling throughout the Beaver Creek drainage indicate that most of the habitat appears to be suitable for resident species.

Water quality data was sampled for each index site. The parameters sampled and recorded for Beaver Creek (1986-1988) are typical of streams within the Tanana uplands. Water quality samplings conducted 1986–1988 provide the first documented results for this stream and indicate that it is suitable for fish. Sampling conducted in 1989 continues to attest to that fact.

Test-netting of fish populations was conducted in 3 index sites. Heavy wind activity prevented testing of the other 4 sites. Hook and line sampling was conducted at all test sites for grayling. Most of the grayling captured appeared to be adults. Based on the mean-average size, they were 2- to 8-year-old grayling, compared to those of Bear and Quartz creeks (Rhine, 1985 and Kretsinger, 1986).

Recreational use reported in 1986 (Van Haveren et al.) covers a handful of trips per year with a total of 30 people. There are no records of these visitors to provide a user population sample for making a comparative analysis. Aerial survey efforts were initiated in 1987 to gather recreational use data on Beaver Creek .

District evaluation trips on Beaver Creek are included in the user counts because of angling opportunities and fish observations. Aerial surveys did not observe or record aircraft on sandbars or landing strips in 1989. It is not known if aircraft users fished since direct contact was not made with the flyers.

Proposed recreational development of the White Mountains National Recreation Area, including increased road access (possibly 1991), trails, overnight camping areas, picnic

areas and river access for Beaver Creek, can be expected to increase recreational use and fishing activity in this area. Increased fishing pressure may lead to a greater harvest of grayling, which will impact the population of older age classes (5- to 9-years-olds) or spawning adult fish. A threshold level for the Beaver Creek grayling could not be determined due to the limited sample size in 1989: only seven days worth of data were collected through selective fishing with hook and line. A recommendation to the Alaska Department of Fish and Game for changes in creel limits and fish management practices may be necessary to protect fish populations and provide for a sustained yield of grayling for anglers.

Observations made on chinook and chum salmon in 1988 indicate a range extension of 31 miles for chinook salmon and 41 miles for chum salmon in Beaver Creek. Documentation of these fish marks the first known records in Beaver Creek above Victoria Creek. Salmon were not observed during overflights in 1989; however, observations made during a float survey on Beaver Creek in late July and early August 1989 documented 35 spawning chinook salmon from Shebal's landing strip to just above Victoria Creek. Most of the spawners were observed at WRM 82.

Water quality data were collected in initial surveys in June and July 1987 on Nome Creek. One set of samples was collected in August 1988 and another in September 1989. These data indicated good quality water for fish species; however, examination of substrate made in 1987, 1988 and 1989 revealed that each sampling site was covered with sediment. Examination of the sampling sites in the tailings meander of the Maze revealed sediment deposition on the stream substrate. It appears that seasonal runoff from the adjacent land surface doesn't have adequate flow to carry silt-laden water through this section of stream. Another contributing factor is the channel conformity, which reduces stream flows and encourages deposition of sediment in this area.

Several sites were examined for potential stream enhancement work (Post, 1986) in conjunction with recreational development. Gabions and other deflecting structures could be used to direct the multiple channels (from 2 to 4) into one channel to concentrate the flow, increase the velocity, flush the sediments from the substrate, and provide additional spawning habitat.

The upper Pavey mining area had been reclaimed, but in 1988 the mining operation was started again on the east side of the claim. These operations terminated in late fall 1988. Prior to reseeding or revegetating the area, observations were made of selected study plots. The natural vegetation recovery was also noted.

Evaluations made of the grass study plot on the west side of Pavey's mining operation indicate that grasses have good potential to provide cover that will control surface runoff. Evaluations made in 1988 and 1989 indicate that expanding the use of grass seeding on reclaimed areas of Nome Creek would enhance riparian habitat.

The revegetation trials conducted in the Maze section of Nome Creek indicated that plant establishment varied considerably. Sites that showed the best plant growth appeared to be sites that contained some fines and had more soil development.

Two of the 3 sites planted had a fair amount of growth, but the performance of the varieties between sites varied considerably. The variation in performance is probably

caused by difference in the substrate. Overall, Nortan and Norcoast Hairgrass, Gruening Alpine Bluegrass, *Siberian Wildrye* and Arctared Red Fescue performed best during the 1989 growing season. However, performance cannot be effectively measured until the plantings have gone through at least one season.

Sites that were seeded with the seed mixture listed on page 2 produced very few seedlings. Plants that had become established were usually found in depressions where the soil was more developed and moisture was more available.

Vegetation that had invaded the sites naturally showed response to the fertilizer. Plants that received fertilizer were much greener at the time of evaluation than those plants adjacent to the fertilized area. Dwarf fireweed had good seed production. The woody vegetation responded well to the fertilizer, and in 1989 some willows had a greater annual growth of 20-24 inches compared to 2-4 inches in 1988.

Although these sites need to be evaluated for at least 2-3 years, useful data has been acquired from the first summer's work. The sites appear to benefit greatly from fertilizer, showing increased growth and possibly increased seed production. The best treatment for these areas may be to periodically fertilize them. Seeding may not produce sufficient benefits to justify cost. Evaluation of these sites over the next 3 years will help identify the best method to enhance revegetation of these old tailing piles.

Dissolved oxygen tests on Colorado Creek Lake (Figure 3) indicate that 3.0 mg/l levels may support grayling, which can tolerate lower dissolved oxygen levels over the winter. Oxygen levels for supporting fish life should be about one milligram per liter.

RECOMMENDATIONS

The BLM's Steese/White Mountains District updated the draft Aquatic Habitat Management Plan, a supplement to the Master Habitat Management Plan, in 1989 for concurrence and approval by BLM management and the Alaska Department of Fish and Game. This plan will provide data to update fisheries resources information in the Beaver Creek River Management Plan in 1992. The White Mountains Aquatic Habitat Management Plan was signed by BLM and the Alaska Department of Fish and Game on September 29, 1989.

The recommendations are as follows:

1. Conduct water quality surveys annually in each of the index sites to measure any changes related to land use activities (recreation, road building, mining). The data will be used to measure and compare possible impacts to the fisheries resources.

2. Survey each index site annually, using 3 or more types of fish sampling gear to increase likelihood of recording previously unrecorded species. The additional collection areas and methods should result in a larger sample size for determing percent of spawners, age classes, sex ratios and K factor of grayling populations. This will provide comparative data for ascertaining species composition, population densities and threshold levels for sustaining harvestable populations of grayling. Also, document condition of fish population so that we can modify management if the future brings decline.

3. Add and delete index sites for a better cross section of habitat and fish population data. Add an index site below the confluence of Nome and Beaver creeks. Add 3 more index

sites (WRM 53 or 55, 70, and 82) between WRM 46 and WRM 88 to sample fish by test-netting the backwater areas or oxbows and to delineate chinook salmon spawning habitat. Delete index site at WRM 90.5 because it is too close to WRM 88 to obtain a good representative sample of fish populations.

4. Conduct monthly aerial reconnaissance from June to September each year to record all uses, especially recreational use, of the Beaver Creek drainage. These records will provide data to make comparative measurements of recreational use for the past (1987-1988), the present (1989), and the future (during and following road development into upper Beaver Creek). Emphasis will be placed on using these recreational overflights to record salmon movements, dates of observation, and habitat where sighted. The addition of 3 or more flights to the seasonal surveys will improve documentation of salmon use of the available habitat in this stream.

5. Continue water quality and substrate sampling annually within the Maze section (Figure 1, A) and other tailings sites in Nome Creek, and measure stream flows. This will provide data for making comparative determinations of road and mining impacts to the fish habitat and will document effects of rehabilitation efforts.

6. Prepare and implement a plan for channel adjustments in upper Nome Creek that will increase flows and reduce sediment deposition within the Maze section. Aerial photos of Nome Creek will provide reference source for enhancement work in the creek. In FY 1991, $67,000 has been requested by the Steese/White Mountains watershed staff to rehabilitate the Bluff section (Figure 1, A) of Nome Creek. Fisheries resource management staff will be involved in that project. Abandoned mine sites and the Maze section within this stream will be revegetated with domestic and native plant species for riparian habitat improvements.

7. Revegetate with varietal grasses because they are readily available commercially. Three non-native species that do well are Poa, Engmo Timothy and Bromes. Observation of growth success at original sites will identify other grass species that will rehabilitate tailings piles. Spreading fertilizer appears to be the most economical way to improve the revegetation of the Maze section.

8. Expand the fish tagging activity, using both plastic streamer tags and radio tags to monitor movements, overwintering areas, spawning areas and feeding habitat in Beaver Creek for grayling and other resident species. Tagging will provide data to compare habitat conditions and fish utilization of stream habitat in subsequent years. The tagging operations should begin in April 1990 and progress through the fall. Conduct tagging and monitoring on an annual basis.

9. Sample dissolved oxygen levels in Colorado Creek Lake in March and April 1990 to determine if levels are suitable for fish. If dissolved oxygen levels are suitable, the lake outlet may be screened to prevent future stocked fish from possibly contaminating native fish in the Beaver Creek drainage. The outlet of the lake may be impounded with a small dam to raise water levels and sustain suitable oxygen levels. The Alaska Department of Fish and Game can stock the lake with graylng fry and BLM can screen the outlet of the lake, construct new access sites and clear new trails into the lake to provide additional fishing opportunties.

10. Coordinate with the Alaska Department of Fish and Game to introduce sterile rainbow trout on a limited basis to determine how they respond to habitat and other species in Beaver Creek. Study of these introductions will directly involve both BLM and ADF&G.

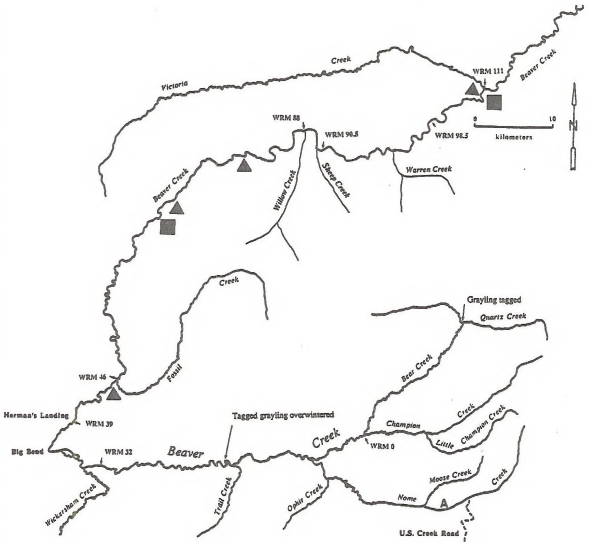

Figure 1. Survey sites by wild river miles (WRM) and 1987-89 salmon observations in Beaver Creek.

1989

Beaver Creek Aerial Survey User Counts

Dates	Section	Time		Completed
		a.m.	p.m.	
06/07	A		4:00	
06/17	B	9:00		
06/27	B		3:00	
07/07	A	8.00		
07/17	B		1:00	
07/27	A		noon	
08/07	A		5:00	
08/17	B	11:00		
08/27	B		2:00	
09/07	A	10:00		

Nome Creek to Victoria Creek = Section A
Victoria Creek to Nome Creek = Section B

Efforts should be made to fly the time and day scheduled. However, weather may require moving the flight either forward or backward by a day. Flight should be on the designated time.

Figure 2. Field Survey Form for User Count, Beaver Creek in the White Mountains National Recreation Area.

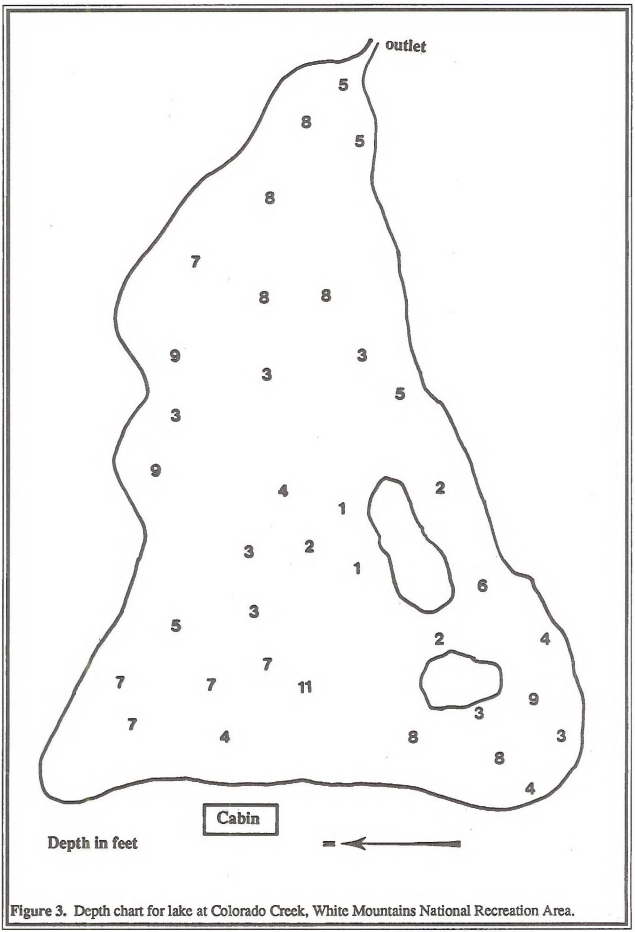

Figure 3. Depth chart for lake at Colorado Creek, White Mountains National Recreation Area.

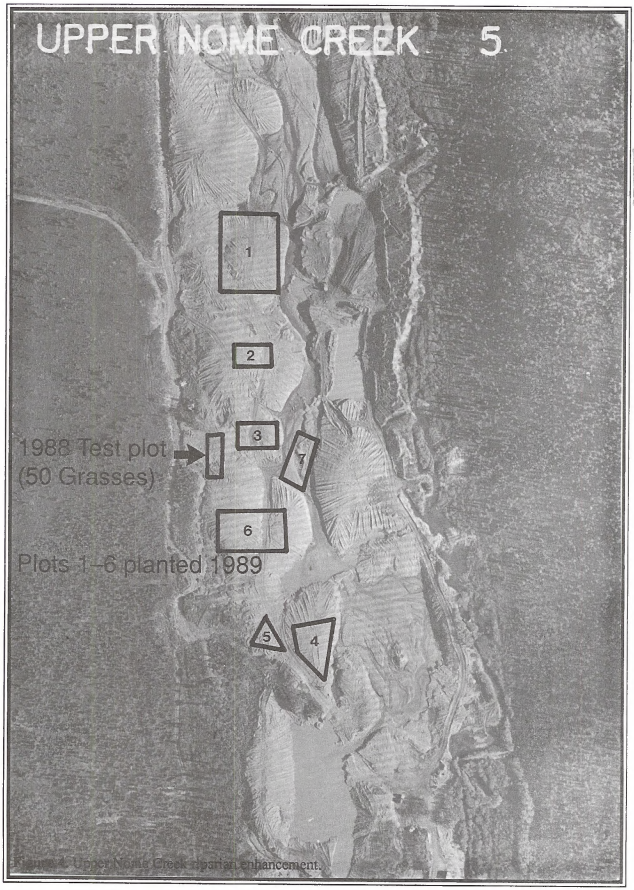

Figure 4. Upper Nome Creek riparian enhancement.

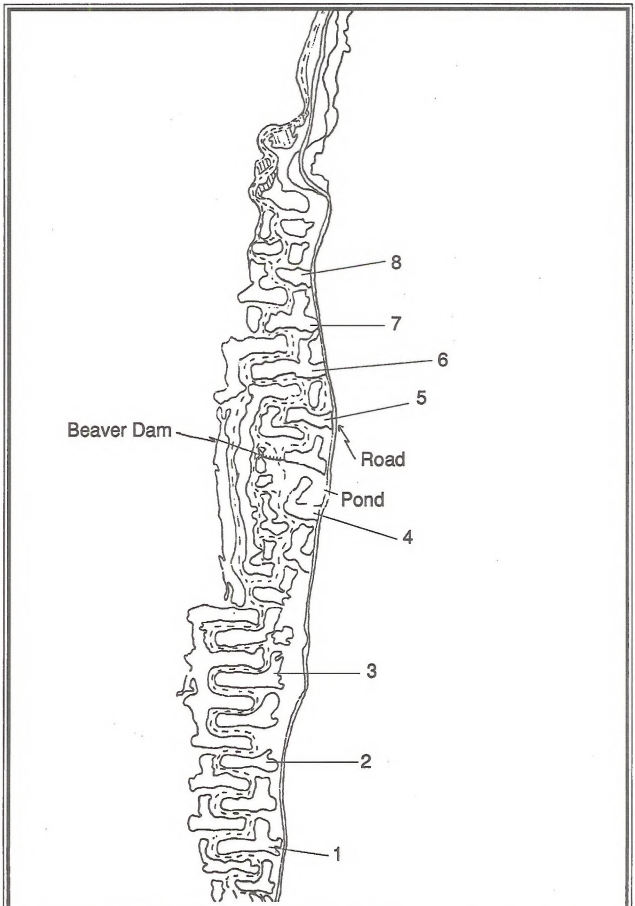

Figure 5. Revegetation Study Plots on Nome Creek at the Maze.

Appendix 1. Scientific names of fish present in Beaver Creek, White Mountains National Recreation Area.

Arctic grayling	*Thymallus arcticus*
Round whitefish	*Prosopium cylindraceum*
Burbot	*Lota lota*
Sheefish	*Stenodus leucichthys*
Northern Pike	*Esox lucius*
Slimy sculpin	*Cottus cognatus*
Longnose sucker	*Catostomus catostomus*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*

Appendix 2. Grass varieties/species in test plots, White Mountains National Recreation Area.

Grass Variety/Species	Hope Creek		Birch Creek #1		Birch Creek #2		Nome Creek	
	% cover	vigor	% cover	vigor	% cover	vigor	% cover	vigor
Nugget Kentucky Bluegrass	40	3	0	0	50	2	50	3
Merion Kentucky Bluegrass	30	3	0	0	50	3	60	2
Banff Kentucky Bluegrass	40	3	0	0	>10	5	75	3
Park Kentucky Bluegrass	40	5	0	0	20	3	90	1
Sydsport Kentucky Bluegrass	40	3	0	0	60	3	75	2
Fylking Kentucky Bluegrass	40	3	0	0	60	3	60	3
Troy Kentucky Bluegrass	30	5	0	0	0	0	50	5
Sherman Big Bluegrass	60	4	0	0	50	3	90	2
Poa ampla	70	3	0	0	90	1	90	1
Canbar Canby Bluegrass	25	5	0	0	>10	7	70	5
Ruebens Canada Bluegrass	25	7	0	0	30	5	70	3
Tundra Glaucus Bluegrass	50	4	0	0	50	4	80	2
Gruening Alpine Bluegrass	50	2	0	0	50	7	85	1
Poa glauca T08867	70	5	0	0	50	5	10	7
Sodar Streambank Wheatgrass	80	3	0	0	90	2	60	3
Agropyron subsecundum 37169	0	0	0	0	0	0		
Agropyron subsecundum Canada	15	3	0	0	5	5	10	3
Nordan Crested Wheatgrass	50	5	0	0	50	5	20	7
Fairway Crested Wheatgrass	70	5	0	0	50	5	10	7
Agrophyron violaceum	40	3	0	0	30	3	15	5
Agropyron boreal	60	2	0	0	80	1	60	2
Summit Crested Wheatgrass	70	4	0	0	50	5	40	5
Critana Thickspike Wheatgrass	50	5	0	0	50	3	50	3
Agropyron yukonese	50	5	0	0	50	3	40	1
Vantage Reed Canarygrass	30	1	0	0	40	5	>10	9
Pults Alkaligrass	0	0	0	0	10	7	0	0
Engmo Timothy	60	2	0	0	70	3	0	2
Climax Timothy	30	5	0	3	60	5	50	5
Elymus sibiricus 345600	80	1	0	0	80	1	80	2
Elymus arenarius	10	4	0	0	50	3	0	0
Nortran Tufted Hairgrass	75	2	0	0	70	3	80	2
Norcoast Bering Hairgrass	60	4	0	1	85	1	50	4
Calamagrostis canadensis Delta	65	3	0	0	50	1	85	4
Sourdough Bluejoint Reedgrass	50	5	0	0	40	3	70	5
Alopecurus geniculatus	30	7	0	0	25	7	0	0
Meadow Foxtail	40	5	0	3	35	3	80	3
Arctared Red Fescue	80	1	0	0	60	2	85	1
Garrison Creeping Foxtail	25	7	0	1	40	4	70	7
Festuca scabrella	70	4	0	0	70	2	85	3
Boreal Red Fescue	65	1	0	1	75	2	90	2
Pennlawn Red Fescue	75	3	0	0	60	5	60	3
Egan Sloughgrass	20	7	0	1	25	5	90	1
Highlight Red Fescue	50	5	0	0	0	0	40	5
Durar Hard Fescue	60	4	0	0	35	3	90	1
Manchar Smooth Brome	85	1	0	0	80	2	50	5
Carlton Smooth Brome	85	2	0	0	50	3	50	3
Pumpelly Brome	80	3	0	0	50	3	60	3
Covar Sheep Fescue	65	1	0	3	40	5	60	9
Alyeska Polargrass	45	1	0	1	15	5	50	7
Tellesy Sage	70	4	0	3	70	2	50	5
SUM	2500	175	0	17	2295	168	2685	167
Mean	50	3.5	0	.34	45.9	3.35	54.79	2.28
STD	22.44	1.88	0	0.85	25.25	1.85	29.25	2.28
VAR	484	3.41	0	.7044	612.69	3.3104	821.38	5.01
Evaluation 1989								

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